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AUTHOR Christenberry, Reid
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ABSTRACT

This paper discusses the problems encountered by the small or medium size college computer center and explores possible solutions to these problems by using the case study technique of examining a particular generalized data management system. The primary source of problems in smaller computer centers often springs from presidential and administrative officers in need of data to make management decisions. They need two types of data: internal, which is necessary for presidents to make decisions that affect internal operation of the colleges; and external, which is data about the college needed to make reports to external organizations on the national and state levels to secure more or better funding for the campus. (Author)

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Administrative Computer Services

TOPICAL PAPERS AND REPRINTS NO. 1
NATIONAL LABORATORY FOR HIGHER EDUCATION

Generalized Data Management Systems For Small Colleges

by
REID CHRISTENBERRY
Director of Computer Services
National Laboratory for Higher Education

The purpose of this paper is two-fold: first, to discuss the problems encountered by the small or medium size college computer center, and secondly, to explore possible solutions to these problems by using the case study technique of examining a particular generalized data management system. The primary source of problems in smaller computer centers often springs from presidential and administrative officers in need of data to make management decisions. They need two types of data: internal which is necessary for presidents to make decisions that affect internal operation of the colleges, and external which is data about the college needed to make reports to external organizations on the national and state levels in order to secure more or better funding for the campus.

Why are all these reports necessary? First, all presidents and administrative officers must be accountable, as far as the campus is concerned, to certain external and internal organizations. Second, each president desires to achieve as efficient an internal operation as possible, thus minimizing his operating costs. The quantity of reports needed suggests that computerized data bases might be useful in gathering, collecting, and accurately reporting necessary information.

Small or medium size colleges have a problem which most large universities do not: large universities have plenty of manpower and money. They can afford to implement computerized data bases, and they can program and computerize any report generation that they need to have. Small or medium colleges (less than 5,000 students) usually have small computer hardware if they have any at all. They have small data processing shops that may have a computer director, an assistant director, an operator, and maybe two or three programmers. All of this implies "double trouble" for the computer center. Small computers are usually slow computers, thus time becomes very important: it is a problem to decide how the computer can be utilized for maximum efficiency. A small staff, the second issue, is often too overworked to be able to produce quickly and efficiently. Consequently, relative priorities have to be set within the computer center as far as programming is concerned: some projects must be delayed in order that other projects can be computerized. By the time a particular project is completed, the application very likely will be out of date. All the work done in preparing the computerized application may have to be repeated: manpower is wasted.

GENERALIZED DATA MANAGEMENT

One possible solution to all of these problems in the small college computer center is a generalized data management system: i.e., a system of computer programs which has been written and implemented once, but can be easily used over and over again in various applications. Even if various applications have nothing to do with one another, the programming and systems analysis work need be done only once. The program is generalized enough to handle any arbitrary data base.

Generalized data management systems are possible because of similarity between common data processing requests. The type of requests that come into a college computer center may consist of an order to set up a data base, to print out reports from that base, and to be able to update the base in order to keep it current. The type of printed reports which are requested primarily involve selection

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Headquartered in Durham, N. C., NLHE works cooperatively with small four year colleges, black colleges, and junior and community colleges to promote constructive change in administration, instruction, and curriculum. The Laboratory's affiliate, the Center for Individualized Instructional Systems (CIIS), works with elementary and secondary schools.

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of a subset of the data base and printing out various data items from the data base records in different orders.

The key to understanding the value of a generalized data management system is knowing the difference between application-oriented programming and generalized programming. Application-oriented programming, which was developed first, is familiar on the small college campus. It consists of analysis and then programming of a particular problem. Its disadvantage is that applications change. Systems analysis done by the analyst a year ago and the computer implementation of a particular application like registration, student records, etc., may change from one year to the next. If you have used application-oriented programming, you need to go back, redo the systems analysis, and possibly reprogram the application on the computer. Hence, you waste manpower and money. In generalized programming, you develop a program so that the particular application (like student records, registration, student information, library acquisitions, or space utilization) could be associated with the generalized system when the people at the college decide to implement their particular computerized application. This is commonly referred to as "deferring the binding of a particular application to the computer programs"; and it is one of the basic characteristics of generalized data management systems.

The concept of generalized data management systems is several years old. It was not used in small or medium size computers, however, until the last few years. The reason is that to write programs which are generalized, a lot of machine memory and resources must be available. It is important that each program have the generalized capability of accepting any particular application. So it would be possible to write smaller programs and quicker programs that were tailor-customed to a particular application. Generally, it is a good policy to implement your computerized application on the computer originally with a generalized data management system. The system can be used as a tool in helping you decide which reports you want and how frequently you want them. Once this is decided, you can devote time to application-oriented programming which will make the system run faster and cheaper on your particular computer.

To help you understand how generalized data management systems work, the NLHE Information Retrieval System will be discussed. The system is designed for small computers (used at small or medium sized colleges). Its relative simplicity compared to other generalized data management systems makes it ideal for the small or medium size college computer center. Retrieving a report from a data base which has been set up with the NLHE system, for example, consists only of entering 3 or 4 cards into the computer which tell it what type of report you want.

The system was originally proposed in January of 1970 by RELCV, the Regional Educational Laboratory for the Carolinas and Virginia, (RELCV was renamed NLHE, the National Laboratory for Higher Education, in 1971.) The NLHE system is not the first retrieval system for small computers. The St. Joseph's College Information System, for example, was developed for the IBM 1130 computer by William G. Verbrugge, E. John Kriegel and Kenneth Zawodny. Routines for fast sorting on the IBM 1130 were later written by B. J. Swain. The NLHE system was coordinated by Mike Abbot, in charge of Information Systems at NLHE from 1969-71. Programming and testing of the system was done by E. James Runde, (then of Clarke College, Dubuque, Iowa) who is now at Furman University in Greenville, S. C., and T. Ray Nanney, also of Furman University. They were assisted by Catherine Watts Frank and several other programmers.

The programming language which was used for the system was Fortran IV which was developed for the IBM 1130 with the Commercial Subroutines Package for that computer. The system assumes a minimum computer configuation of an IBM 1130 computer with 8k memory, 1442 read-punch, 1132 printer, and at least 1 disk drive. Since initial implementation of the NLHE system on the IBM 1130, NLHE has converted this system to run on larger computers such as the IBM S/360 and S/370. The reason for this conversion was to make it available to the small and medium size college computer centers which only have a terminal to a much larger computer. Thus, a person with a teleprocessing terminal to a larger computer also has access to the NLHE system.

There are many known applications of the NLHE Information System. The following list suggests a few:

- Admissions
- Alumni
- Applications for Financial Aid
- Course Reservation
- Development Office Data
- Faculty Data File
- Financial Aid
- Grade Reporting
- Institutional Research
- Inventory Control
- Inventory Reporting
- Library Acquisitions
- Personnel Guidance
- Pre-registration
- Serials
- Space Unilization
- Student Information System
- Union Catalog of Library Holdings

The system consists of two groups of programs: the first is for file maintenance and the second is for information retrieval. As far as file maintenance is concerned, the user can, with the system: describe his file (telling the system what type of data items are to be included), load the file with the data once obtained and key punch into computer readable form, and update and maintain the file on a standard operating basis. As far as information retrieval is concerned, the user can sort the file, select a subset of it, print out this subset, generate statistical reports, and tabulate. Again, one of the outstanding values of the system is that it has a very simple set of instructions which you must give the computer to have a particular report generated. The following list will give you an idea of the type of

instruction that you can give the computer:

Date
Sort
Selection
Print
Format
Reprint
Exit
Frequency
Tabulation
Correlation
End
Titles

CASE STUDY

Now let's look at some particular applications which have been realized with the NLHE system. First of all, look at the sample file of a data base which has been set up at Furman University for admissions. This file description table (figure a) is the key to having a generalized data management system. The programs which have been written to generate the various reports "look at" this file description, which is kept on a computer disk, to see what

FURMAN ADMISSIONS FILE 70-71 FORMAT AS OF FEBRUARY 12, 1971

FIELD DESCRIPTION	ID CODE FOR SORTING AND/OR SELECTING	ID CODE FOR PRINTING	NUMBER OF PRINT POSITIONS	COLUMN HEADINGS ON REPORT	EDIT WORDS FOR PRINT FIELDS	FACTORS USED IN STATISTICAL ROUTINES
SOCIAL SECURITY NUMBER	1	1	9	SOC SEC		
1ST + 2ND NAME OR INITIA	2	2	13	NAME		
LAST NAME	3	3	15	LAST NAME		
INITIALS	4	4	2	IN		
PREFERRED NAME	5	5	9	PREF NAME		
SEX	6	6	1	S		
APPLICANT BIRTHDAY	7	7	6	BIRTH		
PLACE OF BIRTH	8	8	16	BRTH PLACE		
PLANNED DATE OF ENROLLMT	9	9	3	DE		
BOARDING OR COMMUTING	10	10	1	B		
TYPE-NEW,TRANS,RE-AD	11	11	1	T		
EARLY DECISION	12	12	1	E		
CAREER CHOICE	13	13	2	CR		
APPLICANT DENOMINATION	14	14	4	DENM		
APPLICANT HOME ADDRESS	15	15	23	ADDRESS		
CITY	16	16	13	CITY		
STATE	17	17	2	ST		
ZIP CODE	18	18	5	ZIP		
SC COUNTY CODE	19	19	2	CC		
HOME PHONE	20	20	10	PHONE		
MARITAL STATUS	21	21	1	M		
NAME OF SPOUSE	22	22	9	SPOUSE		
NUMBER OF CHILDREN	23	23	1	C		
FOREIGN STUDENT	24	24	1	F		
ALUMNI RELATED	25	25	1	A		
PARENT OR GUARDIAN CODE	26	26	1	P		
PARENT OR GUARDIAN NAME	27	27	23	P/G NAME		
P/G OCCUPATION	28	28	10	OCCUPATION		
P/G EMPLOYER	29	29	30	EMPLOYER		
HIGH SCHOOL F/W GRADUATD	30	30	15	HIGH SCHL		
CEEB HS CODE	31	31	6	CEEB		
TYPE HIGH SCHOOL	32	32	1	H		
FU SCHOLAR	33	33	1	U		
NAT'L MERIT SCHOLAR	34	34	1	N		
LEADERSHIP	35	35	2	LD		
LITERATURE-EDITOR	36	36	1	L		
MUSIC PARTICIPATION	37	37	1	M		
ATHLETICS	38	38	2	AT		
LAST COLLEGE ATTENDED	39	39	15	LAST COLL		
CLASS RANK	40	40	4	RANK		
CLASS SIZE	41	41	4	SIZE		
SAT-VERBAL	42	42	3	STV		1.00
SAT-MATH	43	43	3	STM		1.00
WEEK APPLICAIN RECEIVED	44	44	3	WK		
PREDICTIVE GPA	45	45	3	GPA		0.01
LATEST CLASS RANK	46	46	4	LRNK		
LATEST CLASS SIZE	47	47	4	LSIZ		
HIGHEST SATV	48	48	3	HV		
HIGHEST SATM	49	49	3	HM		
BOARD DECISION	50	50	1	D		
APPLICANT RESPONSE	51	51	1	R		
FINANCIAL AID	52	52	1	F		
TYPE AID	53	53	2	TA		
CONVERTED RANK IN CLASS	54	54	3	CON		0.10
LOADED ON SIS DISK	55	55	1	L		
ENROLLED FALL TERM	56	56	1	E		
HIGHEST SAT TOTAL SCORE	57	57	4	HTOT		1.00

Figure A

particular application is being made of the system at the time. By scanning the table, the generalized programs can determine where certain record fields begin, how long they are and special editing features which should be applied to these fields when they are printed out. On the Furman admissions file description table, several fields are important for making decisions as far as admissions is concerned. As a side comment, it should be pointed out that Furman, like all other schools, likes to make certain that their applicants understand that admissions are made by people, not computers. The data procured from the admissions system is intended only to assist people in making decisions about admissions, not make decisions for them.

Look now at the file description table. Practically all schools will have several common fields in their admissions data base. For example: the name of the applicant, his/her address, place of birth, SAT scores, rank in class. Some fields, obviously, are peculiar to Furman's admissions process. Since Furman is a Baptist-affiliated school in South Carolina, preference is given Baptist applicants, applicants whose fathers are preachers, etc. Furman has in its admissions data base, consequently, certain fields which other schools might not want. This reveals one of the virtues of a generalized data management system: if your particular college does not need a data item in its data base, it need not be put into the file description!

The second file description (figure b) is the Clarke College Alumni Information File. It contains alumni names and addresses, gifts that are given for the last year and the last two or three years. NLHE's system is excellent if you need to get money and what colleges don't today? All you must have is a report of all alumni who gave two years ago but didn't give this year. If someone is going out to towns in the nearby areas, you can have this report printed out for him in geographical order.

So, if your alumni donor office is going to collect money in Hoboken, Deep Step, or another nearby town, you can provide him with a list of contributors who have not given this year. Notice that this file description table looks very similar to the admissions system file description table except that the data items in the table are different. The same set of computer programs are used for both.

The Development Office Donor History File (figure c) contains a record of each donor: the degrees that they received at Furman, their names, their addresses, the date of their last gift, the amount, and their gift history for the last five to ten years.

The next file description table (figure d) shows a library acquisition system. In this file, records are kept on each order that the library places: the title of the book that is being ordered, date of publication, other information about the book, the department that should be charged for it, and even the accession and Library of Congress number and so on.

The programs to generate reports and to maintain the file for all of the applications at which we have looked are the same. They are programs which make up the NLHE Information System. What makes each system different from the other is the file description table. The table is loaded in by a particular program which is part of the NLHE Information System. So it is one set of programs by which all of the previous applications can be easily realized.

CLARKE COLLEGE ALUMNI INFORMATION FILE AS OF SEPT 1970

FIELD DESCRIPTION	ID CODE FOR SORTING AND/OR SELECTING	ID CODE FOR PRINTING	NUMBER OF PRINT POSITIONS	COLUMN HEADINGS ON REPORT	EDIT WORDS FOR PRINT FIELDS	FACTORS USED IN STATISTICAL ROUTINES
ALPHABETIC CODE	1	1	9	ALHPA CODE		
MAIDEN NAME	2	2	20	MAID NAME		
GRADUATION CODE	3	3	1	C		
CLASS	4	4	2	CL		
NAME FOR ADDRESSING	5	5	25	ADDR NAME		
ADDRESS	6	6	20	ADDRESS		
CITY	7	7	14	CITY		
STATE	8	8	2	ST		
ZIP CODE	9	9	5	ZIP		
TITLE	10	10	4	TITL		
DEGREE RECVD	11	11	2	DG		
CAPITAL FUND TOTAL	12	12	7	CAPF	'$ '	1.00
YEAR OF LAST GIFT	13	13	2	Y1		
AMOUNT OF LAST GIFT	14	14	6	AM1	'$ '	1.00
YR OF 2ND LAST GIFT	15	15	2	Y2		
AMOUNT OF 2ND LAST GIFT	16	16	6	AM2	'$ '	1.00
YEAR OF 3RD LAST GIFT	17	17	2	Y3		
AMOUNT OF 3RD LAST GIFT	18	18	6	AM3	'$ '	1.00
GEOGRAPHIC CODE	19	19	2	GC		1.00
TELEPHONE NUMBER	20	20	12	TELEPHONE	' - - '	
MARITAL STATUS	21	21	1	M		1.00
TELEPHONE CODE	22	22	1	T		

Figure B

DEVELOPMENT OFFICE DONOR HISTORY FILE

FIELD DESCRIPTION	ID CODE FOR SORTING AND/OR SELECTING	ID CODE FOR PRINTING	NUMBER OF PRINT POSITIONS	COLUMN HEADINGS ON REPORT	EDIT WORDS FOR PRINT FIELDS	FACTORS USED IN STATISTICAL ROUTINES
DONOR IDENT NUMBER	1	1	7	IDNUMB		
FIRST NAME	2	2	12	FIRST NAME		
INITIAL	3	3	1	I		
LAST NAME	4	4	18	LAST NAME		
HIGHEST DEGREE	5	5	1	F		
SPOUSE OR ASSOC ID	6	6	7	ASOC ID		
DON'T MAIL	7	7	1	D		
ADDRESS LINE 1	8	8	25	ADDRS LN 1		
ADDRESS LINE 2	9	9	20	ADDRS LN 2		
CITY	10	10	13	CITY		
STATE	11	11	2	ST		
ZIP CODE	12	12	5	ZIP		1.00
TITLE	13	13	1	T		
HUSBAND'S INITIALS	14	14	2	HI		
DATE OF LAST GIFT		15	5	DT LG	' / '	
MONTH OF LAST GIFT	15					
YEAR OF LAST GIFT	16					
AMOUNT OF LAST GIFT	17	16	10	AMT L G	'$, . '	0.01
YEAR TO DATE TOTAL GIFTS	18	17	10	YTD GIFTS	'$, . '	1.00
FIVE YEAR GIVING HISTORY		18	5	5 YRS		
GIFT HIST 1 /8	19					
RELATIONSHIP EMPLOYEE	36					

Figure C

Now let's take one of the preceding applications, in particular the Furman admissions file which we looked at first, and look at some of the sample reports which can be obtained from this data base. Figure e displays a print-out, in alphabetical order, of all female applicants who applied under the early decision plan and who have been accepted. This will be a very useful report as far as dormitory space is concerned. You might want a list of just the females who have been accepted and who had applied under early decision. We listed them in alphabetical order and included other data which were not directly related to the subset we selected, but which were nonetheless useful to have: social security number, first name as well as last, sex, decision status, SAT verbal, SAT math, rank in class, and highest SAT total score. The early decision indicator is headed by the column marked E on the report. To get this report from the system, six cards which indicate the selection criteria for selecting the subset of the file that you desire must be fed in. Other cards tell the computer which data to print, the date of the report, etc. They are easily constructed by secretaries, keypunch operators, or computer operators.

LIBRARY ACQUISITION SYSTEM

FIELD DESCRIPTION	ID CODE FOR SORTING AND/OR SELECTING	ID CODE FOR PRINTING	NUMBER OF PRINT POSITIONS	COLUMN HEADINGS ON REPORT	EDIT WORDS FOR PRINT FIELDS	FACTORS USED IN STATISTICAL ROUTINES
ORDER NUMBER	1	1	8	ORDERNO		
AUTHOR	2	2	20	AUTHOR		
TITLE		3	40	TITLE		
TITLE	3					
TITLE CONTINUED	4					
PUBLISHER	5	4	5	PUBL		
DATE OF PUBLICATION		5	4	DATE		
MONTH OF PUBLICATION	6					
YEAR OF PUBLICATION	7					
EDITION	8	6	3	ED		
SERIES	9	7	10	SERIES		
VOLUME	10	8	2	VL		
NUMBER OF COPIES	11	9	1	C		1.00
LIST PRICE	12	10	7	PRICE	'$. '	0.01
INVOICE NUMBER	23	19	10	INVOICENO		
COST OF BOOK	24	20	7	COST	'$. '	0.01
CLASS NUMBER	25	21	20	CLASSNO		
ACCESSION NUMBER	26	22	6	ACCNO		
LIBRARY OF CONGRESS NO	27	23	6	LCNO		
ISBN	28	24	10	ISBN		

Figure D

```
        LISTING OF INPUT CONTROL CARDS
DATE 021271     7TH TEST OF SYSTEM
SORT  3
SORT  4
SELECTION          CRITERIA    =  3
FIELD=(A,1),LIMITS=('E','E')
FIELD=(B,50),LIMITS=('2','2')
FIELD=(C,06),LIMITS=('F','F')
A AND B AND C
FEMALE EARLY DECISION APPLICANTS APPROVED
PRINT  1 2 3 6 50 42 43 40 57  12
END
```

SELECTIVITY INSTRUCTIONS

```
FEMALE EARLY DECISION APPLICANTS APPROVED

BOOLEAN EXPRESSION              A AND B AND C
      BOUNDS SET 'A' IS     EARLY DECISION
          LOWER LIMIT       E
          UPPER LIMIT       E
      BOUNDS SET 'B' IS      BOARD DECISION
          LOWER LIMIT       2
          UPPER LIMIT       2
      BOUNDS SET 'C' IS       SEX
          LOWER LIMIT       F
          UPPER LIMIT       F
```

THIS REPORT WAS GENERATED ON 02/12/71.
7TH TEST OF SYSTEM

THE FOLLOWING ARE THE COLUMN HEADINGS AND AN EXPANDED EXPLANATION

COLUMN	FIELD NO	HEADING	EXPLANATION
1	1	SOC SEC	SOCIAL SECURITY NUMBER
2	2	NAME	1ST + 2ND NAME OR INITIA
3	3	LAST NAME	LAST NAME
4	6	S	SEX
5	50	D	BOARD DECISION
6	42	STV	SAT-VERBAL
7	43	STM	SAT-MATH
8	40	RANK	CLASS RANK
9	57	HTOT	HIGHEST SAT TOTAL SCORE
10	12	E	EARLY DECISION

NO TALLYING OR SUBTOTALS ON THIS RUN

THE NUMBER OF RECORDS PRINTED ON THIS REPORT IS 9

DATE 02/12/71 PAGE 1
TYPICAL RUN

SOC SEC	NAME	LAST NAME	S	D	STV	STM	RANK	HTOT	E
092423218	JANYCE	DDDDR	F	2	569	650	0068	1219	E
163462969	ELIZABETH ANN	GGGGG	F	2	641	530	0009	1171	E
205404132	ELEANOR M	HHFHM	F	2	681	566	0005	1247	E
211440794	KATHLEEN M	HHHHS	F	2	560	624	0014	1184	E
212668979	CYNTHIA SUSAN	IIIIF	F	2	595	680	0130	1275	E
215502026	JUDITH S	IIIIO	F	2	576	660	0114	1236	E
215508148	JULIA ANN	IIIIQ	F	2	608	662	0009	1270	E
215508149	JENNIFER LEE	IIIIR	F	2	602	586	0102	1188	E
219564398	NANCY LOUISE	JJJJJ	F	2	582	700	0001	1282	E

THE NUMBER OF RECORDS PRINTED ON THIS REPORT IS

Figure E

There is absolutely no need for the computer programmer to intervene in order to get the report.

The next report (figure f) is a sample to demonstrate how you can select subsets from the admissions file. All people who made a score of more than 1050 on a cumulative SAT and were in the top ten of their class were selected. The report was printed in alphabetical order. As you can see, the fields requested were last name, name, highest SAT total, and rank in class. In this particular case, only 31 applicants met these criteria, out of a sample data base of about 200 applicants. To get the report only 8 cards were used. The difference in this report and the last one at which we looked is that different selection criteria were used, different fields were printed out and it may have been sorted into a different order. The same programs however generated both reports.

DATE 11/15/71 PAGE 1
APPLICANTS WITH HIGHEST ST

LAST NAME	NAME	HTOT	RANK
AAAAB	S LUAN	1070	0002
BBBBC	EDSEL WAYNE	1170	0010
BBBBT	SHELLEY	1159	0010
BBBBX	DAVID TYLER	1070	0001
CCCCA	JOHN THOMAS	1075	0007
DDDDM	DAVID PHILIP	1173	0010
DDDDQ	JANE IDA	1200	0001
EEEEK	MARILYN B	1390	0004
EEEER	EDMUND A	1265	0007
FFFFZ	NANCY FORREST	1290	0003
GGGGG	ELIZABETH ANN	1171	0009
GGGGJ	CLINTON RAY	1458	0006
GGGGY	JANET MARIE	1471	0002
HHHHM	ELEANOR M	1247	0005
HHHHT	DONALD ALAN	1434	0007
IIIIA	MARSHA ANNE	1050	0003
IIIIH	RICHARD B	1418	0007
IIIIJ	JANET LYNN	1160	0010
IIIIQ	JULIA ANN	1270	0009
IIIIX	CATHERINE E	1311	0004
JJJJH	LINDA G	1388	0007
JJJJJ	NANCY LOUISE	1282	0001
KKKKA	SUSAN LEIGH	1169	0009

THE NUMBER OF RECORDS PRINTED
ON THIS REPORT IS 23

Figure F

The third report (figure g) generated from the admissions data base is commonly called in an admissions office the "High School Book." It is a listing, ordered according to high school (a separate page for each school. The page of this high school book for Walt Whitman High lists, in alphabetical order, all applicants as well as their address, phone number, board decision, and high school attended. This would be a very useful report if your recruiting officer were going to a particular town: for example, Greenwood, South Carolina. If he had this page in Greenwood, he could call any particular applicant and, perhaps, inform them of their status; and he could convey, having the above information, the personal attitude of his admissions office. For the recruiting officer who is going to visit a high school advisor or counselor, this report would be useful in helping him give the counselor the status of all applicants from that school. To generate this report with the NLHE system takes 6 or 7 cards. All you have to do is tell the computer to sort the file into a particular order, to page whenever it detects a change in high school code, and to print out the data on any particular applicant you need to know about.

```
        LISTING OF INPUT CONTROL CARDS
DATE 071271 HIGH SCHOOL BOOK
SORT 31
SORT 3
SORT 2
PRINT  3 2 15 16 17 20 50 30
FORMAT CONTROL BREAK DOUBLE SPACE
END
```

•••••

DATE 07/12/71 PAGE 47

LAST NAME	NAME	ADDRESS	CITY	ST	PHONE	D	HIGH SCHL
BBBBA	JON GAIL	5916 KIRBY RD	BETHESDA	MD	3016567237	3	WALT WHITMAN
IIIIS	LISA KAREN	9305 RENSHAW DRIVE	BETHESDA	MD	3014697430	5	WALT WHITMAN
IIIIZ	CECILY D	1 WINTERBERRY CT	BETHESDA	MD	3012294480	3	WALT WHITMAN
JJJJF	STEPHEN PAUL	6531 79TH PLACE	BETHESDA	MD	3013650737	2	WALT WHITMAN
JJJJK	WILLIAM IVAN	5304 BROOKEWAY DRIVE	SPRINGFIELD	MD	3016569219	3	WALT WHITMAN

Figure G

Report generation is not all that the NLHE Information System can do. In most generalized data management systems, there are capabilities other than file maintenance and simple report generation. The next report (figure h) shows some of these. It is what is commonly called a frequency distribution. This is useful in the admissions process because it can provide a profile of the average applicant, as well as the distribution of all applicants in relation to the profile. This particular report, as you can tell at the top, is a frequency distribution for SAT verbal scores. It consists only of those students who are approved applicants. Frequency distribution starts at 200 and goes to 800, which is the range of possible scores on SAT verbal. To the side of each interval, are the number of observations or applicants which fall into that range, the cumulative frequency, the percent, and cumulative percent. At the bottom of the statistical report we have the maximum value, minimum value, average value, and standard deviation printed out as well. Generation of a frequency distribution with the NLHE system is very simple. All you need do is add one more card than what you have been adding in your regular report. On this card you provide the lower end of the frequency range, the number of steps you wish the frequency distribution to go up, and the width of each stop. You also tell on which field you want the frequency distribution done. Frequency distributions and all other statistical reports handled by the NLHE system can be done on any selective subset of the data base.

```
        LISTING OF INPUT CONTROL CARDS
   DATE 072871
SELECTION          CRITERIA = 1
FIELD=(8,50),LIMITS=('2','2')
   (8)
APPLICANTS APPROVED

SELECTION     CRITERIA = 1
LIMITS=('M','M'),FIELD=(C,06)
 ( C)
MALES
FREQUENCY   42  200.  50.  13
FREQUENCY   43   200.   50.   13

FIELD=(D,06),LIMITS=('F','F')
(D)
FEMALES
FREQUENCY   42  200.  50.  13
FREQUENCY   43   200.   50.   13
FREQUENCY   57   650.   50.   20
FREQUENCY    57   650.   25.   40
END
```

APPLICANTS APPROVED

INTERVAL	FREQUENCY	CUMULATIVE FREQUENCY	PER CENT	CUMULATIVE PER CENT
200.000 AND BELOW	0	0	0.0	0.0
600.001- 650.000	18	12	17.82	81.19
650.001- 700.000	13	95	12.87	94.06
700.001- 750.000	6	101	5.94	100.00
750.001- 800.000	0	101	0.0	100.00
800.001 AND ABOVE	0	101	0.0	100.00

SUPPLEMENTARY STATISTICS

THE MAXIMUM VALUE WAS 733.000
THE MINIMUM VALUE WAS 310.000
THE AVERAGE VALUE IS 551.772
THE STANDARD DEVIATION IS 94.846

Figure H

The next report (figure i) is a sample of a correlation coefficient calculation. The correlation coefficient is a Pearson product correlation coefficient for any two fields. In this particular report, the SAT verbal and the SAT math converted rank in class and SAT verbal, the predictive grade point average and SAT verbal, SAT verbal and highest SAT total, and class rank and SAT verbal were correlated. Supplementary statistics which consist of average standard deviation and the number of cases are also present.

Finally, you can get a tabulate (figure j) report. The admissions office, for example, may want to know the number of female students that have applied; the number of male students that have applied, the number of female boarding students, female commuting, male boarding and male commuting; and the number from each state within each one of these categories. That's what this report gives you. It allows you to tabulate up to 10 fields of cross tabulation. For example, by looking at this report it is clear that there are 4 female boarding students from Florida; there are 25 female boarding students from Maryland. The reports shows that there are 97 female boarding students and then the female commuting students begin to be tabulated. At the bottom of this page we find there are 6 female commuting students and a total of 103 female applicants. To generate this tabulate report with the NLHE system requires only 5 cards.

The NLHE Information System is only an example of generalized data management systems. It, like all other systems, has its vices and virtues. Most of its vices come because it was designed to run on a small computer. If you have a larger computer than the 1130, you will probably have, in terms of power, a better generalized data management system.

The National Laboratory for Higher Education has developed another system which will help the small college computer center. The system is a Generalized Budgetary Accounting General Ledger System for the IBM 1130. It allows the business office in a small or medium size college to keep detailed information about their general ledger accounts. It provides reports on encumbrances, budgetary amounts, and all unemcumbered balances, and on all income and expense accounts. The system will also accept any existing chart of accounts, therefore, the business office doesn't need to modify their accounting numbering system in order to be compatible with this general ledger computer system. The system will handle multiple campuses, funds, and subfunds (or schools). It is now available for the small or medium size colleges who are overloaded with (1) keeping records of the dollars they have spent and promise to spend, and (2) being able to budget their expenditures and incomes on an accurate and timely basis.

CALCULATION OF CORRELATION COEFFICIENTS DATE 08/02/71
TEST CORRELATION CALCULATIONS

VARIABLE 1	VARIABLE 2	NUMBER OF CASES	COEFFICIENT OF CORRELATION
SELECT THE ENTIRE FILE			
SAT-VERBAL	SAT-MATH	238	0.603
CONVERTED RANK IN CLASS	SAT-VERBAL	233	-0.403
PREDICTIVE GPA	SAT-VERBAL	233	0.735
SAT-VERBAL	HIGHEST SAT TOTAL SCORE	238	0.892
CLASS RANK	SAT-VERBAL	233	-0.266

SUPPLEMENTARY STATISTICS ON ABOVE VARIABLES

VARIABLE	AVERAGE	STANDARD DEVIATION	NUMBER OF CASES
SAT-VERBAL	499.844	96.525	238
SAT-MATH	543.487	99.474	238
CONVERTED RANK IN CLASS	33.149	23.771	233
PREDICTIVE GPA	1.902	0.565	233
HIGHEST SAT TOTAL SCORE	1043.723	175.220	238
CLASS RANK	100.004	104.964	236

Figure I

01/28/71

FIELD HEADING DESCRIPTION

6	S	SEX
10	B	BOARDING OR COMMUTING
17	ST	STATE

S	B	ST	LEVEL 3 TOTAL	LEVEL 2 TOTAL	LEVEL 1 TOTAL
F	B		1		
F	B	CT	6		
F	B	DC	1		
F	B	DE	6		
F	B	FL	4		
F	B	GA	3		
F	B	IL	1		
F	B	MA	2		
F	B	MD	25		
F	B	ML	1		
F	B	NC	4		
F	B	NJ	11		
F	B	NY	13		
F	B	PA	10		
F	B	RI	2		
F	B	SC	4		
F	B	TN	1		
F	B	VA	1		
F	B	VT	1	97	
F	C	NY	1		
F	C	PA	1		
F	C	SC	4	6	103

Figure J